



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

# RAMP

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# Robotic Armed Maneuver Platform (RAMP) aka Wingman



## Interoperable Software Architectures



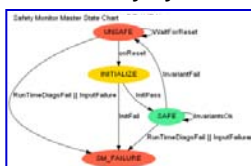
## Notional Armed Turret



## Integrated Platform And Turret Control



## UGV Safety Systems



## Notional UGV Platform



## Autonomous Navigation & Behaviors System



## Purpose:

*Develop, integrate, and demonstrate an armed robotic platform that is capable of performing tactically relevant maneuvers.*

## Products:

### Safe Armed Operations

- Aided target recognition & engagement
- Automated turret control
- Low latent remote fire

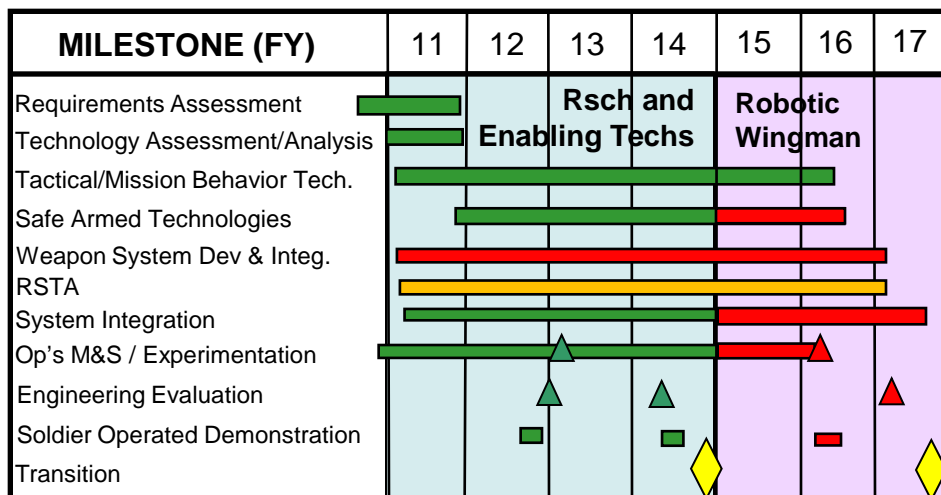
### Autonomous Tactical Behaviors

- Automated maneuvers in tactical formations
- Interaction of Manned and Unmanned Systems:
- Manned/unmanned intelligent teaming through advanced unmanned vehicle systems
- Common command and control of platform and turret

## Payoff:

- Get Robotic Platforms in the Hands of the User
- Reduce Fleet Weight
- Increased Warfighter Survivability
- Increased Warfighter Lethality
- Reduced risk of future armed UGV integration

## Schedule & Cost





# RAMP Wingman Enabling Technologies



Pre 2009

2009

2010

2011

2012

2013

2014

2015

2016

2017

Robotic Follower

Convoy Active Safety Technologies

Near Autonomous  
Unmanned System

Robotic Vehicle Control Architecture

Multiple previous efforts culminate in  
the Robotic Wingman

Robotic Armed Maneuver Platform (RAMP) - Wingman

ARL CTA

Safe Operations of Unmanned Systems for Reconnaissance in  
Complex Environments

Safe Ops

Increased Mobility and Operational  
Performance through Autonomous  
Technologies

Robotics CTAs





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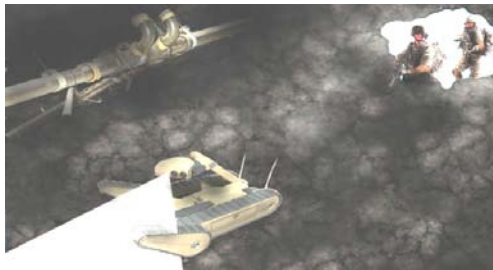
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# SOURCE

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# D.TAR.2009.03 Safe Operations of Unmanned systems for Reconnaissance in Complex Environments (SOURCE)



## Schedule & Cost

MILESTONE (FY)	09	10	11	12
Technology/Requirements Assessment	■		■	
Perception & Control Technologies - Safe Operations, Situational Awareness		5	■	6
Tactical/Mission Behavior Technologies - Cooperative & Dynamic Behaviors		5	■	6
Platform Integration		■		■
Engineering Evaluation		▲	▲	▲
M&S Experiments		■	■	■
Field Experiments		5	■	6
<b>Total</b>				
TARDEC				
ARL				
ERDC				

## Purpose:

Develop and demonstrate Perception, Intelligence, control and Tactical Behavior technologies that are required for autonomous collaborative unmanned systems (UMS) & Soldiers to conduct safe operations in a dynamic urban environment.

## Products:

- Perception sensors & planning algorithms for safe operations in dynamic/urban environments
- Tactical behaviors for mission execution (including MULE and SUGV class robots)
- Modeling & simulation software
- Integrated testbeds and data to develop UGV safety & testing procedures/methodologies in preparation for Interim Qualification Testing (IQT)
- Quantitative performance data to enable development of TTPs for UGVs

## Payoff:

- Remove warfighter from hostile situations
- Safer operations of UGVs in proximity to pedestrians and vehicles
- Increase in vehicle autonomy to enable less supervisory burden and reduced network loads
- Increased UGV situational awareness
- Robust soldier/robot and robot/robot teaming behaviors
- Robust UGV performance in all environments/conditions





# D.TAR.2009.03 SOURCE Joint Partnership Overview

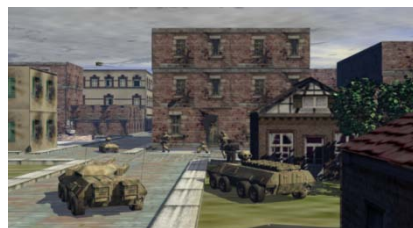
## TARDEC

- Maturation, Integration & Demonstration



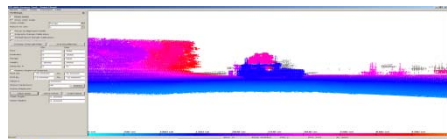
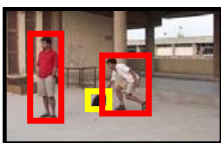
## ERDC

- Physics-based Simulation



## ARL/VTD

- Perception, Planning & Tactical Behavior Algorithms



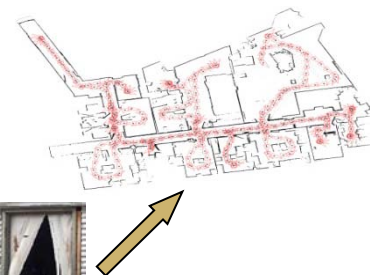
## ARL/HRED

- Soldier-robot teaming and trust in automation



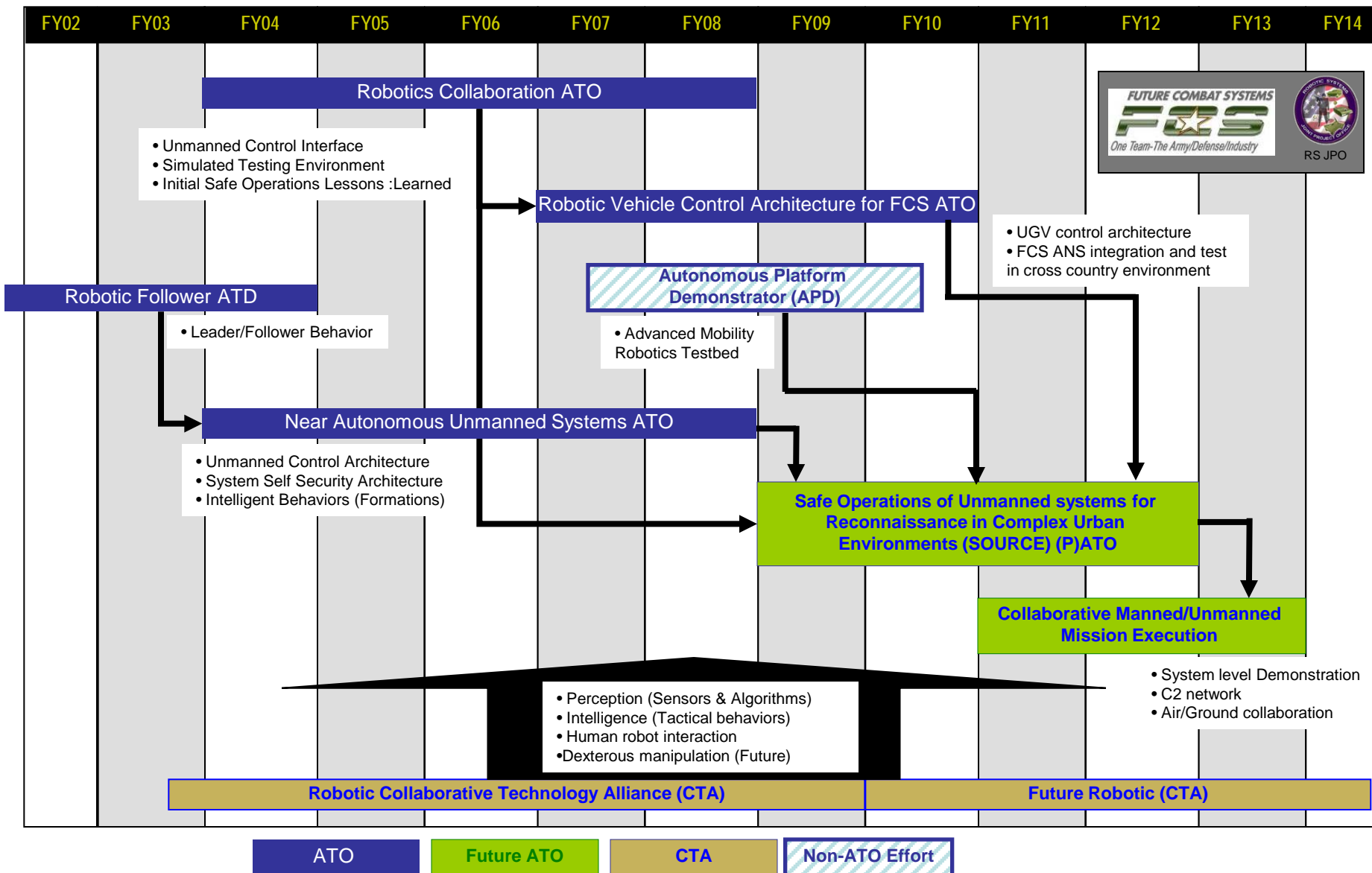
## ARL/CISD

- Indoor Navigation & Mapping





# D. TAR.2009.03 Safe Operations of Unmanned systems for Reconnaissance in Complex Environments (SOURCE)

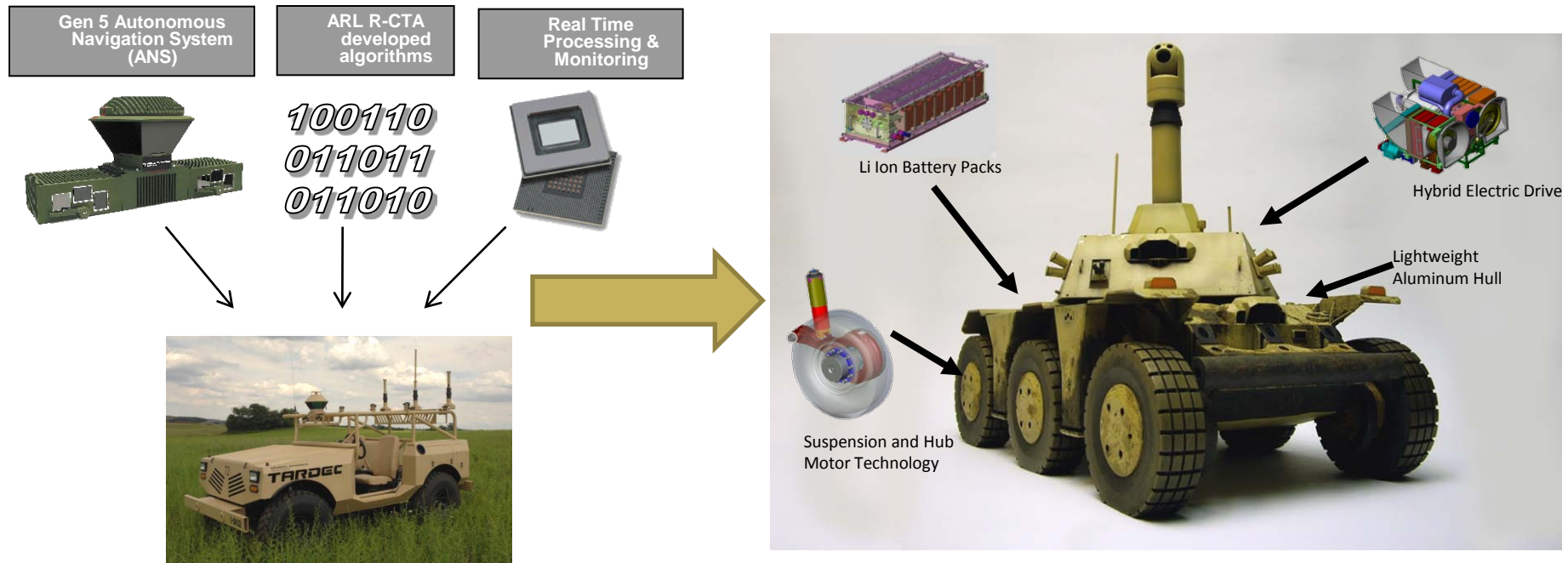






# SOURCE Large Platform

- Autonomously maneuver, operate and negotiate urban terrain
- Autonomously traverse paved roads at sustain speeds of 45KPH
- Autonomously traverse complex urban terrain at 8 KPH
- Detect oncoming vehicles at oncoming speeds of 80KPH and ranges of 50m
- Detect and Track humans up to 50m (standing and moving) and at speeds up to 10KPH
- Detect and avoid non-human entities moving at 10KPH





# SOURCE – Small Robots

## OBJECTIVE

- Enable dismounted operations of small scale robots in urban and complex environments using collaborative semi and fully autonomous behaviors, persistent surveillance, and mapping.

## CHALLENGES

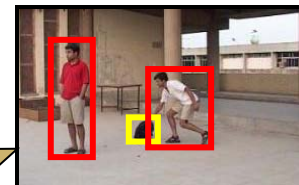
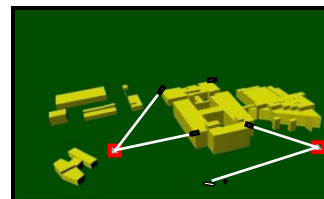
- Limited autonomous behaviors for SUGV
- Sensors don't yet exist to enable full autonomy on small robots
- Localization challenges in GPS-denied environments
- Persistent surveillance technology (including on moving robot)

## SOLDIER PAYOFF

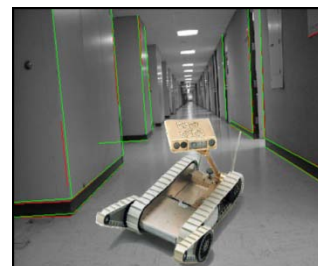
- Reduced Soldier Workload
- Enhanced Situational Awareness

Technology Partners: ARL, SPAWAR, INL

## Persistent Surveillance



## Indoor Navigation And Mapping



## Indoor Navigation And Mapping

